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Research Spotlights

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Editorial for the Special Section on Humans, Algorithms, and Augmented Intelligence: The Future of Work, Organizations, and Society

Hemant Jain, Balaji Padmanabhan, Paul A. Pavlou, T. S. Raghu (p. 675)

Human-computer symbiosis has the potential to address some of the most difficult issues facing society today. Indeed, information science (IS) researchers have embraced both augmented intelligence (AI) and IA (Intelligence Augmentation) traditions, highlighting the design and rational schools of thoughts in research papers, notes, and commentaries. However, there is still a lack of integrated discussion and a comprehensive body of literature on the direct implications of how IA and AI research can contribute to various applications to individuals, organizations, and society and to their impact on the future of work. In this editorial commentary, we lay out the historical context; we introduce a framework for studying the future of work implications from an individual, organizational, and societal perspective; and we discuss important research directions for IS research and related disciplines in the domain of AI and IA.

Dynamic, Multidimensional, and Skillset-Specific Reputation Systems for Online Work (p. 688)

Marios Kokkodis

Current reputation systems in online (labor) markets are overly positive and unidimensional. This article presents a new reputation framework that combines human input with machine learning to provide dynamic, multidimensional, and skill-set-specific quality assessments. The framework significantly outperforms current reputation systems. By providing more representative reputation scores, the framework helps workers to differentiate, employers to make informed decisions, and the market to improve its recommendation algorithms and understand the supply distributions across different dimensions. The framework generalizes in other contexts where reputation systems are overly positive and unidimensional. The framework highlights how combining human input with advanced machine learning techniques can augment intelligence by creating the necessary conditions for humans to make informed decisions. Such systems have the potential to increase efficiency and outcome

quality precisely because they intelligently differentiate workers. The deployment of the proposed intelligence augmentation framework in different types of online platforms could have implications for workers, employers, businesses, and the future of work.

Augmenting Medical Diagnosis Decisions? An Investigation into Physicians' Decision-Making Process with Artificial Intelligence (p. 713)

Ekaterina Jussupow, Kai Spohrer, Armin Heinzl, Joshua Gawlitza

Systems based on artificial intelligence (AI) increasingly support physicians in diagnostic decisions, but they are not without errors and biases. Failure to detect those may result in wrong diagnoses and medical errors. Compared with rule-based systems, however, these systems are less transparent and their errors less predictable. Thus, it is difficult, yet critical, for physicians to carefully evaluate AI advice. This study uncovers the cognitive challenges that medical decision makers face when they receive potentially incorrect advice from AI-based diagnosis systems and must decide whether to follow or reject it. In experiments with 68 novice and 12 experienced physicians, novice physicians with and without clinical experience as well as experienced radiologists made more inaccurate diagnosis decisions when provided with incorrect AI advice than without advice at all. We elicit five decision-making patterns and show that wrong diagnostic decisions often result from shortcomings in utilizing metacognitions related to decision makers' own reasoning (self-monitoring) and metacognitions related to the AI-based system (system monitoring). As a result, physicians fall for decisions based on beliefs rather than actual data or engage in unsuitably superficial evaluation of the AI advice. Our study has implications for the training of physicians and spotlights the crucial role of human actors in compensating for AI errors.

Estimating the Impact of "Humanizing" Customer Service Chatbots (p. 736)

Scott Schanke, Gordon Burtch, Gautam Ray

In this work, we investigate how applying human-like characteristics to customer service chatbots can influence retail outcomes. This is an important managerial question as creating effective chatbot experiences

through messaging platforms has proven difficult for organizations. Often, chatbot developers apply characteristics such as giving a chatbot a human name, adding humor, and so on, without knowing how these features influence end user behavior. Implementing a field experiment in collaboration with a dual channel clothing retailer based in the United States, we automate a used clothing buy-back process, such that individuals engage with the retailer's autonomous chatbot to describe the used clothes they wish to sell, obtain a cash offer, and (if they accept) print a shipping label to finalize the transaction. We provide evidence that, in this retail setting, anthropomorphism is beneficial for transaction outcomes, but that it also leads to significant increases in consumers' sensitivity to the offer amount. We argue that the latter effect occurs because, as a chatbot becomes more human-like, consumers shift to a fairness evaluation or negotiating mindset.

Learning from Crowdsourced Multilabeling: A Variational Bayesian Approach (p. 752)

Junming Yin, Jerry Luo, Susan A. Brown

Microtask crowdsourcing platforms provide an online marketplace where task requesters can submit microtasks for a crowd of workers to complete. As the information collected from a crowd can be prone to errors, additional algorithmic techniques are needed to infer the ground truth labels. In this paper, we present a variety of new approaches for modeling label dependency and worker quality in the context of multi-label crowdsourcing. To capture label dependency, we introduce three methods based on a Bayesian mixture of Bernoulli distributions, its Dirichlet process extension, and a multivariate logit-normal distribution. We also propose two distinct generative models for characterizing shared and hierarchical structures of worker quality. Efficient variational inference algorithms are then developed to jointly infer ground truth labels and worker quality. Extensive experiments show that the models based on integrating Bernoulli mixtures and shared structure of worker quality achieve the best performance. Our study clearly highlights that joint and effective modeling of label dependency and worker quality is crucial to a multilabel crowdsourcing system. The proposed framework also has great potential to be extended to a broader range of applications, where different opinions need to be combined to measure multiple perspectives of an object.

Human–Robot Interaction: When Investors Adjust the Usage of Robo-Advisors in Peer-to-Peer Lending (p. 774)

Ruyi Ge, Zhiqiang (Eric) Zheng, Xuan Tian, Li Liao

Artificial intelligence has been increasingly used in financial services. How should humans interact with such

intelligent tools? And what is the consequence when humans intervene the use of AI? This paper studies the human–robot interaction of financial advising services in peer-to-peer lending (P2P). Many crowdfunding platforms have started using robo-advisors to help lenders augment their intelligence in P2P loan investments. Collaborating with one of the leading P2P companies, we examine how investors use robo-advisors and how the human adjustment of robo-advisor usage affects investment performance. We find, somewhat surprisingly, that investors who need more help from robo-advisors—that is, those who encountered more defaults in their manual investing—are less likely to adopt such services. Investors tend to adjust their usage of the service in reaction to recent robo-advisor performance. However, interestingly, these human-in-the-loop interferences often lead to inferior performance. This occurs because humans tend to focus more on short-term returns and make myopic adjustments. Our study's findings help robo-advisor marketers and designers understand and predict user behavior regarding the adoption and usage of such services and help them better design robo-advisors thereof.

Just DM Me (Politely): Direct Messaging, Politeness, and Hiring Outcomes in Online Labor Markets (p. 786)

Yili Hong, Jing Peng, Gordon Burtch, Ni Huang

Text-based direct messaging (DM) systems are widely adopted in internet-based systems, such as Twitter and Discord. We study the role of direct messaging in online labor markets, which provides a communication channel between workers and employers, adding a personal touch to the exchange of online labor. We seek to evaluate the effect of workers' use of the direct messaging system on employers' hiring decisions and conceptualize the information role of direct messaging. We leverage data on the direct messaging activities between workers and employers across a large sample of job applications on a leading online labor market. The empirical evidence shows that direct messaging with a prospective employer increases a worker's probability of being hired by 8.9%. Further, we find that the benefits of direct messaging for workers depend a great deal on the politeness of the workers, and this "politeness effect" is amplified for lower-status workers (i.e., workers lacking tenure and job fit) and workers who share a common language with the employer. As the economic activities are increasingly digitized, understanding online employment is now more important than ever. Our findings provide insights into when and what to message to achieve favorable hiring outcomes in online employment settings.

Focus Within or On Others: The Impact of Reviewers' Attentional Focus on Review Helpfulness (p. 801)

Zhanfei Lei, Dezhi Yin, Han Zhang

When reviewers write online reviews, they differ in the focus of their attention: some focus on their own experiences, whereas some direct their attention to others—prospective consumers who may read the reviews in the future. This paper explores how, why, and when reviewers' attentional focus can influence the helpfulness evaluation of reviews beyond the impact of substantive review content. Using one archival analysis and five controlled experiments, we find that reviewers' attentional focus can influence consumers' perception of review helpfulness through both the positive process of perceived empathic concern and the negative process of perceived persuasion motives, and that the overall effect of attentional focus is contingent on the reviewer's two-sidedness. Because review platforms can increase consumer perceptions of the platform and increase site "stickiness" with more helpful reviews, we suggest that review platforms consider incorporating a reviewer's attentional focus into their review-writing guidelines to encourage the creation of more helpful reviews. In particular, a shift in attentional focus combined with both pros and cons may be most effective in boosting review helpfulness.

Platform Competition Under Network Effects: Piggybacking and Optimal Subsidization (p. 820)

Yifan Dou, D. J. Wu

A repeated challenge in launching a two-sided market platform is how to ignite the cross-side network effects to jump-start adoption. This research note studies "piggybacking"—expanding the focal market to recruit exclusive users from external networks—as a new and nonpricing control to launch platforms in conjunction with pricing controls. We first consider consumer-side piggybacking. Our results provide a rich set of novel insights into strategies that platforms use to monetize exclusive access to external users with nontrivial characterizations of the interplay among piggybacking, cross-side network effects, and price competition. We identify conditions when piggybacking is profit improving and when it leads to a prisoner's dilemma, depending on the piggybacking cost and strengths of cross-side network effects. Among others, we show that piggybacking may intensify rather than ease price competition. We then consider provider-side piggybacking, and we show that the insights are qualitatively the same as consumer-side piggybacking except that the prisoner's dilemma disappears if piggybacking providers multihome.

Winning by Learning? Effect of Knowledge Sharing in Crowdsourcing Contests (p. 836)

Yuan Jin, Ho Cheung Brian Lee, Sulin Ba, Jan Stallaert

Crowdsourcing is a new way for online crowds to get involved in a company's research and development process. Businesses can host public contests on online platforms (such as Kaggle, Topcoder, and Tongal) to seek new product ideas and technological solutions. In the contest communities, members usually have a "cooperative" relationship: they compete against each other for the contest prize, while at the same time also cooperate with each other by sharing information and knowledge. This work investigates the effect of knowledge sharing in such crowdsourcing contests. Surprisingly, we find that the knowledge sharing process may not always help improve crowdsourcing contestants' performance. The effectiveness of knowledge sharing is influenced by the volume, quality, and generativity of shared knowledge. Shared knowledge is only beneficial when it is of high quality or when it has high potential of being further developed collectively by the community. Meanwhile, the development process has to be diverging; narrowing the development process in one direction can restrict the community creativity and negatively influence crowdsourcing performance. Our work informs the crowdsourcing practitioners to be more cautious when they enable collaboration such as knowledge sharing for the contest community.

User Competence with Enterprise Systems: The Effects of Work Environment Factors (p. 860)

Weiling Ke, Lele Kang, Chuan-Hoo Tan, Chih-Hung Peng

Enterprise system users are required to improve competence to gain the system's value. The development of user competence to effectively use a complex system is socially constructed. Based on the job demands-resources model, we propose and empirically validate how two types of work contextual factors, namely, job demands and job resources, are directly and interactively related to user competence. Results of a longitudinal survey from users in six organizations suggest that all three job resource factors considered—leader-member exchange, traditional support structures, and peer support structure—allow users to acquire both the technical and business knowledge needed for effective application of the system for work. But, work overload, as the job demand factor, has no significant effect on user competence. Further analysis shows the relationship between work overload and user competence is moderated by leader-member exchange, but not the two support structures. Our findings are of great importance for practice, as they suggest job resources are conducive to the development of user competence, whereas work overload is an inevitable, acute problem.

Multidimensional Observational Learning in Social Networks: Theory and Experimental Evidence (p. 876)

Liangfei Qiu, Arunima Chhikara, Asoo Vakharia

The unprecedented growth of social network users in the last decade has resulted in significant increases in the availability of individual-specific information such as holiday pictures, mobile check-ins at restaurants, and information on everyday purchases. Consumers shopping through social network channels are increasingly using this information in making their purchase decisions. We find that social ties impact the magnitude of observational learning. In the case of strangers, the effect of learning is stronger for vertically differentiated products than for horizontally differentiated products; whereas in the case of friends, the effect of learning for vertically differentiated products is similar to that for horizontally differentiated products. Moreover, the type of product impacts the magnitude of observational learning. For horizontally differentiated products, the effect of learning from friends is stronger than that from strangers; whereas for vertically differentiated products, the effect of learning from friends is similar to that from strangers. These findings provide motivation for online retailers to generate alternative strategies for increasing product sales through social networks. For example, online retailers offering horizontally differentiated products have strong incentives to cooperate with social media platforms (e.g., Instagram and Pinterest) in encouraging customers to share their purchase information.

On the Spillover Effects of Online Product Reviews on Purchases: Evidence from Clickstream Data (p. 895)

Young Kwark, Gene Moo Lee, Paul A. Pavlou, Liangfei Qiu

Marketing practitioners have viewed word-of-mouth (WOM) or user-generated content as influential marketing tools. We show that the role of the mean review rating can spill over across other products in a consumer's market basket and that this spillover role is different across media channels (mobile or personal computer) and across products of the same versus different brands. Our result on media channels, the salient impact of review ratings on mobile media, suggests the unequal importance of mean ratings across media channels and need for a differentiated design of marketing messages across devices. In addition, the perception of brands and the effect of WOM across brands have been key factors for marketers to leverage the marketing mix. Therefore, our paper also contributes to marketing practitioners by helping to understand these brand effects on consumers' decisions. Additionally, we reveal that the impact of the review ratings differs

in terms of an individual consumer's experience and the variance of the review ratings. Retailers often use data about consumer activities and product reviews for sales prediction and tailored recommendations. In this regard, our results help retailers better leverage the nuanced role of the review ratings.

Not Registered? Please Sign Up First: A Randomized Field Experiment on the Ex Ante Registration Request (p. 914)

Ni Huang, Probal Mojumder, Tianshu Sun, Jinchi Lv, Joseph M. Golden

Online commerce websites often request users to register in the online shopping process. Recognizing the challenges of user registration, many websites opt to delay their registration request until the end of the conversion funnel (i.e., ex post registration request). A new study in *Information Systems Research* explores an alternative approach by asking users to register with the website at the beginning of their shopping journey (i.e., ex ante registration request). The authors of the study show that the ex ante request leads to an increased probability of user registration. Furthermore, the ex ante request leads to considerable increases in customer purchases in the long run and does not significantly influence sales in the short run. Further investigation into the long-term and short-term effects provides suggestive evidence on several potential mechanisms, such as firm-initiated interaction (e.g., email marketing campaigns) and screening of low-interest users (i.e., users with low initial valuations of the website and in a potentially disengaged state). This study provides managerial implications on the design of user-registration systems in e-commerce websites.

Designing Personalized Treatment Plans for Breast Cancer (p. 932)

Wei Chen, Yixin Lu, Liangfei Qiu, Subodha Kumar

Breast cancer remains the leading cause of cancer deaths among women around the world. Contemporary treatment for breast cancer is complex and involves highly specialized medical professionals collaborating in a series of information-intensive processes. This poses significant challenges to optimization of treatment plans for individual patients. We propose a novel framework that enables personalization and customization of treatment plans for early stage breast cancer patients undergoing radiotherapy. Using a series of simulation experiments benchmarked with real-world clinical data, we demonstrate that the treatment plans generated from our proposed framework consistently outperform those from the existing practices in balancing the risk of local tumor recurrence and radiation-induced adverse effects. Our research sheds new light on how to combine domain knowledge and patient data in developing effective decision-support tools for

clinical use. Although our research is specifically geared toward radiotherapy planning for breast cancer, the design principles of our framework can be applied to the personalization of treatment plans for patients with other chronic diseases that typically involve complications and comorbidities.

The Impact of an Augmented-Reality Game on Local Businesses: A Study of Pokémon Go on Restaurants (p. 950)

Vandith Pamuru, Warut Khern-am-nuai, Karthik Kannan

Augmented reality (AR)-based applications have been growing in prominence. Pokémon Go, one of the most popular AR game applications, has been engaging in strategic partnership with businesses. The game combines geospatial elements with gamification practices to incentivize user movement in the physical world. In this study, we examine the value of such strategic partnerships between Pokémon Go and associated businesses. Specifically, we use data of the online reviews for a firm to study consumer engagement and consumer perception after the release of the game on its associated businesses. We find that restaurants associated with Pokémon Go do indeed enjoy a higher level of consumer engagement and more positive consumer perception. We also find that characteristics of the business significantly moderate this impact overall. Using a parsimonious analytical model, we also demonstrate the mechanism behind these results. Our study provides insights into consumer economic behavior in the context of AR applications. We further inform the business owners and policymakers regarding the potential value of such strategic business partnerships with such applications.

Discount Schemes for the Preemptible Service of a Cloud Platform with Unutilized Capacity (p. 967)

Shi Chen, Kamran Moinzadeh, Yong Tan

Rapid growth in the cloud industry not only provides tremendous opportunities to cloud providers who have invested heavily in computing capacities, but also leads to low utilization of capacities at times. To alleviate this problem, some providers have launched a low-priority service with the so-called preemptible or spot instances, which allows them to reclaim capacities when necessary. This study focuses on an emerging market segment of customers with fault-tolerant computing jobs, who are the potential users of the preemptible instances. Through an analytical model that captures the underlying supply-demand dynamics, we examine a prevalent discount scheme, which provides all users the same discount, and its impact on key performance measures. Having realized that this is a relatively new market segment and there is room for improvement in discount-scheme designs, we

propose an interruption-based discount scheme, which provides compensation to users based on the frequency of interruptions encountered by each of them. Our study suggests that the proposed scheme is fairer than the prevalent scheme from the customers' perspective and that, in the presence of risk-averse customers, the cloud provider could be better off by adopting the proposed scheme when the supply of the surplus capacity is highly uncertain.

Making Digital Innovation Happen: A Chief Information Officers Issue Selling Perspective (p. 987)

Daniel Qi Chen, Yanlin Zhang, Jinghua Xiao, Kang Xie

We encourage chief information officers (CIOs) to play more active roles in organizational level strategy making in the digital era and examine *how* CIOs could lead their organizations' digital innovation initiatives. We propose that it is the CIO's effectiveness in issue selling (i.e., the acts that are directed toward affecting top management teams' (TMT) attention to and understanding of strategic issues), rather than his or her structural position, that directly influences the level of organizational digital innovation success. Nevertheless, CIO structural power should not be overlooked because it could amplify (i.e., positively moderate) the impact of CIO issue selling to digital innovation outcomes. In addition, we identify four enabling forces of CIO issue selling effectiveness: (1) CIO strategic decision-making authority, (2) CIO/TMT partnership, (3) CIO information technologies (IT)-related strategic knowledge, and (4) CIO political savvy. Matched-pair survey data collected from senior business and IT executives of 179 organizations largely support the research hypotheses.

Network Interconnectivity and Entry into Platform Markets (p. 1009)

Feng Zhu, Xinxin Li, Ehsan Valavi, Marco Iansiti

Digital technologies have led to the emergence of many platforms in our economy today. In certain platform networks, buyers in one market purchase services from providers in many other markets, whereas in others, buyers primarily purchase services from providers within the same market. Accordingly, network interconnectivity—which measures the degree to which consumers in one market purchase services from service providers in a different market—varies across different industries. This paper examines the impact of network interconnectivity on the defensibility of an incumbent with presence in multiple markets against an entrant that seeks to enter one of these markets. Interestingly, even if the entrant can advertise at no cost, it may not want to make every user in a local market aware of its service. Additionally, stronger

network interconnectivity may not make the incumbent more defensible. The results have important managerial implications for platform owners to understand their competitiveness in connected markets for resource planning and marketing strategy design, and for policy makers to take into account the network interconnectivity when considering the anticompetitive issues in platform markets.

Reporting Technologies and Textual Readability: Evidence from the XBRL Mandate (p. 1025)

Xitong Li, Hongwei Zhu, Luo Zuo

The eXtensible Business Reporting Language (XBRL) can standardize numerical disclosures and make it easier for computers to process and compare financial reports. This perceived benefit of XBRL has prompted the U.S. Securities and Exchange Commission to mandate that public firms must submit financial statements in the XBRL format as part of their financial reports. Leveraging the research opportunity created by the XBRL mandate, we examine whether financial reporting technologies affect how firms construct textual disclosures. We find that the initial adopters' HTML-formatted annual reports become harder to read after the XBRL mandate. Further analysis reveals that this effect is concentrated among adopters with more quantitative disclosures, a smaller firm size, or a higher level of financial complexity. Importantly, we show that managers' reduced attention to preparing HTML-formatted annual reports, rather than increased disclosures, is likely the explanation for this decrease in textual readability. We also find that the negative effect on textual readability persists at least in the subsequent year. Our findings suggest that the XBRL adopters need to pay attention to process optimization and technology enablement to mitigate the possible negative effect of XBRL adoption on the readability of financial reports.

Understanding Inconsistent Employee Compliance with Information Security Policies Through the Lens of the Extended Parallel Process Model (p. 1043)

Yan Chen, Dennis F. Galletta, Paul Benjamin Lowry, Xin (Robert) Luo, Gregory D. Moody, Robert Willison

A key approach in many organizations to address the myriad of information security threats is encouraging employees to better understand and comply with information security policies (ISPs). Despite a significant body of academic research in this area, a commonly held but questionable assumption in these studies is that noncompliance simply represents the opposite of compliance. Hence, explaining compliance is only half of the story, and there is a pressing need to understand the causes of noncompliance, as well. If organizational leaders understood what leads a normally compliant

employee to become noncompliant, future security breaches might be avoided or minimized. In this study, we found that compliant and noncompliant behaviors can be better explained by uncovering actions that focus not only on efficacious coping behaviors, but also those that focus on frustrated users who must sometimes cope with emotions, too. Employees working from a basis of emotion-focused coping are unable to address the threat and, feeling overwhelmed, focus only on controlling their emotions, merely making themselves *feel* better. Based on our findings, organizations can enhance their security by understanding the "tipping point" where employees' focus likely changes from problem-solving to emotion appeasement, and instead push them into a more constructive direction.

Role of Social Media in Social Protest Cycles: A Sociomaterial Examination (p. 1066)

Monideepa Tarafdar, Deepa Ray

Contemporary social media fueled social protest action is decentralized, self-organized, constitutes vast populations, and is shaped by concurrent channels of information flows through multiple digital technologies. Who can forget the powerful images of the many different social media fueled protests, across the world, in 2020 and early into 2021? Such protest activity is captured in the concept of social protest cycles, which are short periods of intense societal protest activity, characterized by rapid temporal dynamics, confrontation and potential violence, and possible institutional action. Social protest cycles contain the seeds of potential societal transformation because the scale and intensity of their protest action can be constructively harnessed toward institutionalized social change. They are the micro-foundations of social media enabled social movements and influence their progress and future direction. This research explains the role of social media in social protest cycles. Social media enabled protest cycles progress through three types of activities, namely using social media to consolidate people around a common identity, to mobilize people to take offline and online protest action, and to intensify protest action, often into clashes with authority structures. Given the emergent nature of these actions, the scope of protest action in social media enabled social protest cycles cannot be predicted beforehand. There is a need for those in civic and political leadership to be constantly aware of and attuned to the nature of social media use in order to understand their temporal prominence and respond constructively in a timely and informed manner. Our findings provide practical implications for understanding and possibly intervening in these short cycles of intense protest activity with a view to engaging in constructive dialog oriented toward facilitation and redress of citizens' grievances in a timely manner.